DOCUMENT RESUME

ED 168 151 EA 011 425

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TITLE	Using Within-Unit Behavior of Teachers to Inform the School-Level Analysis: Approaches to Data Analysis in Project MITT.
INSTITUTION	Oregon Univ., Eugene. Center for Educational Policy and Management.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	78
NOTE	42p.; Some tables may not reproduce clearly due to light print; For related documents, see ED 161 153, EA 011 403-404
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Behavior Change; Computer Oriented Programs; *Data Analysis; Educational Innovation; Educational Research; Elementary Education; Group Behavior; *Statistical Analysis; Tables (Data); *Teachers; *Team Teaching
IDENTIFIERS	Project MITT

ABSTRACT

The purpose of this report by the staff of Management Implications of Team Teaching (MITT) was to explain the use of unit-level analysis to get a more exact characterization of the general innovative phenomena previously observed in unitized schools. The report examines three central variables that describe involvement of the teaching staff in the innovation--collegial decision-making, instructional interdependence among teachers, and reciprocated communication among teachers. Individual chapters explain (1) how the outcome variables were arrived at, (2) how the effects of unitization on teacher involvement were arrived at, (3) how unit-level indices on three variables (team management, instructional interdependence, and communication) were formulated, and (4) how the analysis incorporating unit characteristics concerning the three main variables were formulated and their meaning. (Author/LD)

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USING WITHIN-UNIT BEHAVIOR OF TEACHERS TO INFORM THE SCHOOL-LEVEL ANALYSIS: APPROACHES TO DATA ANALYSIS IN PROJECT MITT

by

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Spring, 1978
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The research reported herein was supported in part by funds from the National Institute of Education, U.S. Department of Health, Education, and Welfare. Opinions expressed in this report do not necessarily represent the policies or positions of the National Institute of Education, nor should any official endorsement of the report be inferred from the reporting agencies.

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Introduction

An analysis task faced by the MITT (Management Implications of Team Teaching) staff was one of refining the school-level analysis with a more exact characterization of the general innovative phenomena we had observed in the unitized schools. We studied an innovation which was to be installed school wide but whose success closely depended, at least conceptually, upon the integrity of the teaching teams within the school and the extent of teacher activity within each team. A school level analysis by itself would have ignored the possible crucial role of teaching teams; a team level analysis alone would have ignored extra-team behavior and could not have characterized the innovation as an overall success or failure in the school.

Conceivably, the desired activities among teachers could take place in the absence of such teams. Teacher behavior in teams had implications for but was not necessarily a requisite for successful change in the school. Restricting the analyses to either the school or team level would have ignored this fact. We thought it logical to examine the innovative activities that occurred exclusively within units in order to assess the extent to which the general school-level observations we had previously made actually reflected implementation efforts by the units in each school.

The MITT Research Project

Project MITT (Management Implications of Team Teaching) researched elementary schools each of which had initiated a large scale change in the

formal structural program of a large group of students. Each team had a designated leader and all leaders together with the principal constituted a cabinet for coordinating unit activities and handling extra-unit affairs in the school.

In the fall of 1974, sixteen elementary schools in the MITT sample had formed their entire teaching staffs into units; accompanying the unit organization were a variety of optional instructional and curricular reforms. Thirteen schools generally in the same districts as these innovative schools acted as controls. None had adopted any similar structural reform during the course of the study, nor had any adopted school-wide instructional or curricular innovations, although individual teachers or small groups occasionally tried out new methods and materials. The design of the MITT study called for a data collection in the spring of 1974, approximately six months prior to unitization in the fall, and in the fall and spring for each of the two years following the formal establishment of units.

Teacher Involvement in the Innovation

Our designation of schools as innovative rested solely on the changes in the formal instructional and managerial arrangements but with no requirements for behavioral changes in teaching staffs. However, such changes did constitute MITT's substantive definition of change via the new structure since their expression establishes the manner in which teachers, the users of the innovation, put the project into practice, if at all.

Accordingly, only the continued active involvement of teachers in new roles and role relationships consonant with the goals of the Multiunit model could ensure any measure of successful adoption. Attention in the MITT Project to key variables reflecting major teacher role changes allowed us to determine if, where, when, and how long (within the time constraints of our design) teacher behavior changed. This report examines three central variables which describe involvement of the teaching staff in the innovation -- Collegial Decision-Making, Instructional Interdependence Among Teachers, and Reciprocated Communication Among Teachers.

The Outcome Variables

Previous research and theory led us to expect teachers to change the nature of their decision-making activities. As members of units, they were to manage jointly the instructional matters of all the students for which their unit was responsible. This meant that each teacher would sacrifice some measure of the autonomous individual classroom decision-making authority s/he normally enjoyed as an isolated teacher to the collegial group comprising his/her unit. In addition, a principal would transfer to the units his/her authority to make certain decisions. In essence, teachers would change from individual to group decision-makers, and the amount and breadth of their collegial decision-making would increase to, and remain at, a level above that found in conventional schools.

The raw data for expressing the collegial decision-making in the school came from a lengthy and highly detailed interview concerning the Control Structure in the school. The nature of the interview format allowed us to determine, for each topic about which a decision had been made, who made the decision and who was governed by it. We were specifically interested in those decisions for which a group of teachers who made the decision were also all affected by it -- what we chose to call Collegial Decision-Making (Packard et. al., 1976; Jovick, 1978).

Another area to which we looked for evidence of continued behavioral change was, of course, instruction. We expected to find teachers engaging increasingly in joint teaching with one another following the establishment of units in the schools; more and more they would link up with other teachers in an exchange of students within and across subject areas rather than keep themselves and "their own" class of students isolated from other faculty.

We gathered the raw data for identifying instances of this phenomenon from logs on which teachers merely checked, for a two-week period, which pupils they taught and on which days. With an appropriate outlay, these data allowed us to identify instances of Instructional Interdependence, cases in which a pair of teachers taught the same students in the same subject. We also could identify instances of what we call Throughput Interdependence, cases in which teachers share the same pupils in different subjects. Our major interest, however, was in Instructional Interdependence because it implicated a more observable and significant role change in teachers due to the necessary contingencies surrounding such teaching activities (Packard, et. al., 1976).

We naturally expected the changes in instructional and managerial behaviors of teaching to demand a relatively persistent alteration in the pattern of communication among teachers with respect to both classroom instruction and school-wide affairs. We assumed that the general amount and frequency of communication would shift upward and that teachers would engage in more reciprocated communication.

The raw data for assessing the communication patterns in the school came from a sociometric-like instrument completed by each teacher. On a sheet listing all classroom teachers in the school, teachers indicated how often they talked to each other about classroom and school-related topics. From a matrix of all responses in a school we could identify tne presence of reciprocated communication between pairs of teachers (Packard, et. al., 1976).

These three aspects of teacher involvement in the innovation process, as discussed here, refer only to post-unitization activities. Fullan (1972) points to the additional importance of preparatory involvement of teachers prior to the actual start-up of such an innovation. Certainly, early role change reflected in instructional interdependence, collegial decision-making, and new communication patterns would evidence this; however, Fullan refers more to factors reflecting early teacher involvement and perceptions such as their participation in the decision to adopt the innovation, their perceptions of role change difficulties, their sense of control over the direction the innovation will take, their clarity about the changes to come, and their perceptions of the relative advantages/disadvantages of the innovation.

The MITT Project collected such data prior to the establishment of units in the schools as part of an effort to find pre-implementation predictors of eventual successful/unsuccessful installation of the innovation. Other project reports (Packard et. al., 1976, 1978; Packard and Jovick, 1978) present a more extended description of these variables and some initial prediction results. We mention these kinds of variables here only as an indication of the breadth of the data in the MITT study concerning aspects of teacher involvement in the process of change in their schools.

Effects of Unitization on Teacher Involvement

For our interdependence index (NPI), we counted the number of pairs of teachers in a school who shared the same students in the same subject area more than once during the ten-day period covered by the logs. We calculated collegiality scores for each of two areas -- Classroom Instructional Process (COLL1) and Deployment of Students and Teachers in the organization of instruction in the school (COLL2) -- as the percentage of all decisions made by a group of teachers and governing the same group of teachers. Jovick (1978) details the nature of these areas and the basis for forming the indices. Finally, we calculated four indices of reciprocated communication, an intensity (INTCL, INTSC) and an extensity (EXTCL, EXTSC) score for communication about classroom and about school-wide matters.

Reciprocated communication required that Teacher 1 indicate that s/he spoke with Teacher 2 and Teacher 2 also indicate s/he spoke with Teacher 1. The frequencies of communication designated by both would then be averaged between them to give the pair a frequency score. Extensity of communication was the number of pairs of teachers in the school participating in reciprocated communication; intensity was the average frequency of communication for those pairs engaging in reciprocated communication (Packard et. al., 1976).

To demonstrate the influence of unitization on mean levels of each of these variables, Table 1 presents the data comparing unitized and nonunitized schools separately for each wave.

TABLE 1: MEANS AND STANDARD DEVIATIONS OF SELECTED SCHOOL LEVEL VARIABLES FOR EXPERIMENTALS (N = 13) AND CONTROLS (N = 13)[a]

		Experimentals		Controls	
		Mean	S.D.	Mean	S.D.
NPI	T1	1.77	1.96	1.23	1.69
	T2	5.15	3.72	.69	.75*
	T3	5.31	3.57	1.08	1.89*
	T4	3.54	2.37	1.00	1.00*
	T5	3.69	2.06	.69	1.11*
COLL 1	T1	9.96	8.34	7.93	6.58
	T2	18.22	10.61	9.11	6.48*
	T3	18.13	5.93	7.92	5.30*
	T4	15.82	11.50	3.75	2.97*
	T5	20.08	12.45	4.32	4.09*
COLL 2	T1	26.81	14.87	14.99	13.13*
	T2	30.45	18.68	9.20	9.68*
	T3	37.99	19.37	10.74	14.47*
	T4	36.64	22.70	10.62	15.43*
	T5	43.88	27.71	7.26	11.50*
INTCL	T1	2.65	.49	2.59	.43
	T2	2.22	.37	2.33	.74
	T3	2.40	.49	2.31	.65
	T4	2.16	.29	2.18	.35
	T5	2.31	.43	1.97	.43
INTSC	T1	2.23	.59	2.16	.48
	T2	1.89	.33	1.97	.65
	T3	2.03	.40	2.01	.34
	T4	2.00	.21	1.94	.40
	T5	2.09	.38	1.80	.32*
EXTCL	T1	22.38	14.67	16.77	8.55
	T2	53.92	46.30	39.46	23.21*
	T3	51.54	38.30	35.31	25.94
	T4	45.31	24.06	39.08	23.04
	T5	51.62	35.22	42.77	25.03
EXTSC	T1	25.46	18.43	24.08	14.23
	T2	74.23	57.82	53.77	29.27
	T3	74.92	56.32	49.77	32.71
	T4	58.31	32.26	48.62	24.56
	T5	68.46	48.03	56.08	33.33

*Significant difference in means at $\alpha = .05$, df =24.

[a]Three schools omitted. See text, p. 18.

At T1, only COLL2 showed a significantly greater advantage in the experimental schools. By T2, the unitized schools manifested distinctly higher levels in NPI, COLL1 and COLL2 which remained through T5. EXTCL also showed a higher level at T2 in the unitized schools but the significant difference disappeared thereafter. INTCL and INTSC were at significantly greater levels at T5 for the unitized schools but the p values for the t-tests were borderline.

Within the unitized schools, from the first to the second year the level of NPI dropped slightly while that for COLL1 increased; the T2 level of COLL2 remained unchanged through T5. The intensity of communication for both school and classroom matters decreased while the extensity of school-related communication increased from the first to the second year; the extensity of classroom-related communication did not change.

To further examine these changes we began looking at unitized schools alone, but at some point it became evident that the school-level indices we computed for these variables lacked the descriptive potential we desired.

Because the innovation was intended to be installed as school-wide change, we had originally thought it proper to cast the behavioral expression of it as school-wide phenomena. Yet, much of the success of the installation of the innovation hinged at least conceptually on the activity within units.

It struck us that what we had done with our interdependence and communication indices was aggregate information about pairs of teachers as if each pair were isolated from and independent of other teachers. The multiunit structure, however, raised the chances that pairs of teachers were not isolated but rather taught and communicated primarily within the context of the team.

Similarly, our collegial decision-making index had also ignored the intended central management role of the unit. Because of the way information was collected to form the classification of decisions as being made collegially (see Jovick, 1978) we were unsure as to just how much within-unit collegial decision-making was reflected in the scores.

Of course, we had assumed all along that if units were fully functional throughout the school with respect to interdependence, collegiality and communication, then their respective indices would be high in value. However, the possibility existed that some schools would be high on both but that those high values would not necessarily reflect the nature or extent of within-unit involvement in instructional interdependence and collegial decision-making throughout the school. Indeed, teachers could communicate and share students within the same subject area with others in their own unit and in other units; similarly, teachers could join with their own unit members and with others in

different units where circumstances demanded or permitted a collegial decision process.

The changes expected from the multiunit reorganization ostensibly comprised school-wide phenomena, not merely unit or teacher-pair activities. Although activity essential to the innovation was to occur in the unit, ideally it should have occurred in all units in the school. Perhaps it was an unrealistic expectation that a successful school be comprised of all or a majority of successful units; that is, could a school hope to muster the needed interplay of forces so that all units could end up successful, thereby making the school successful? Would one still consider a school successful if only 30%-50% of its units were actively implementing the innovation?

We had classified schools as Successful or Unsuccessful on the basis of their relatively high or low scores on Interdependence and Collegiality at T5. (We used COLL2 because it correlated strongly with NPI whereas COLL1 did not.) These two variables were used to make the classification because they reflected the two major areas of expected change. Schools high on both at T5 were considered Successful, those low on both were considered Unsuccessful. Following this grouping we examined through-time trends in Interdependence Collegial Decision-making, and Communication for the two sets of schools.

A major point of concern was that we may have been too quick to characterize a school as Successful or Unsuccessful without reference to how much of that definition was carried by only a few successful units within the school or even by a few isolated pairs of teachers in different

units in the school. By looking at our school-level indices alone, we risked drawing erroneous inferences about unit activity in the schools without examining the activity of the units themselves in the schools. Conversely, looking only at the activity of units, we risked assuming that our so-called Successful schools consisted entirely of successful units. We realized the characteristics tapped by our original school-level indices potentially failed to provide an accurate and comprehensive description of teacher involvement in the innovation. Using within-unit information about teacher involvement, however, we could investigate the extent to which the presence of units that were successfully engaging in instructional interdependence, communication, and joint decision-making characterized different degrees of implementation success in the school at different points in time. In fact, we did not understand the place of the unit structure in the successful implementation of interdependence and collegiality in the school and therefore felt it worthwhile to examine what happened to units over time in the sets of schools we had chosen to call Successful and Unsuccessful.

For example, the possibility existed that a Successful school may have had only a few of its units actively carrying out the total number interdependent relationships by which we characterized the school as a whole, and perhaps only a few isolated pairs of teachers within those few units determined that total number. Other unit data about the average frequency with which pairs of teachers within the unit share students

in the same subject area offered us another potential perspective of the degree of implementation in a school which we could not see in an index like NPI. Certainly, a Successful school with much NPI may actually have contained units with many instructionally interdependent teacher pairs but all of them tending to share students infrequently. Similarly, data on communication among teachers within the unit and the extent of their managerial responsibility as a group showed promise of refining our notion of successful implementation.

Unit-level Indices

Some time after we had been deeply into analyses with these and other school-level indices, we had compiled a file which contained exclusively unit-level indices at each wave T2 through T5. The analyses we originally envisioned for these indices were adjunct to the main analytical thrust and quite apart from any school-level analyses we had been conducting. Several unit indices paralleled those of the school level and, in many cases, were constructed from the same raw data. The unit had been singled out rather than the school or the individual teacher or teacher pair because the great majority of task-interdependent relationships occurred within rather than across unit membership lines and because unit structure had greater stability across the time period studied than did internal memberships and liaisons. (We had witnessed considerable turnover of personnel from year to year and frequent shifting of pairwise relationships.)

Several unit-level indices paralleled those of the school level and, in many instances, used the same raw data to form aggregated scores. A brief description of the unit indices used to reflect the school indices of collegial decision-making, instructional interdependence, and communication follows below; it draws heavily on Duckworth and Jovick (1978).

Team Management

The "collegial decision-making" scores do not use data that is amenable to distinctions among units in the same school. For our unit governance variable -- team management -- we therefore employed teachers' responses to a different item on the questionnaire.

Teachers had been given a list of five school management functions: supervising aides, supervising new teachers, scheduling special-subject teachers, grouping students for instruction, and determining teaching schedules. The item asked where the responsibility for each function lay -- with the principal, a committee, unit leaders, the unit as a whole, or individual teachers. For each teacher, we computed the proportion of functions for which the unit as a whole was indicated as responsible, and then averaged this proportion over all members of the unit to provide a measure of joint management responsibility (UNITACT). This raw score could vary from "0" to "5", i.e., from no functions exercised jointly to all five exercised jointly.

Instructional Interdependence

From the instructional logs kept by teachers we had been able to identify pairs of teachers who engaged in instructional interdependence bonds. We aggregated that information into diffusion or extensity scores (ISAT) for each unit to reflect the number of active intra-unit pairs (we ignored the few cross-unit pairs) as a proportion of the number of possible pairs in the unit, given the number of logs returned.

$$\text{Diffusion of Instructional Interdependence (ISAT)} = \frac{\text{Number of pairs with instructional interdependence}}{\frac{n(n-1)}{2}}$$

where n = number of logs returned by unit members in each data collection.

We chose this ratio rather than the simple number of pairs because units varied in size from two to eight persons (although three- or four-person units constituted from 69% to 80% of the sample, depending on the wave) and because a single interdependent pair has a different meaning in a three-person unit than in a six-person unit. These scores range from "0", indicating no interdependence, to "1.00", indicating that all teachers in the unit are completely interconnected with interdependence bonds.

In addition to this measure, we extracted an additional piece of information about each unit concerning the ambitiousness or intensity (INSCOAV) of the instructional interdependence whenever it did occur. For each unit, this index described the average frequency with which teachers in instructionally-interdependent pairs posed contingencies for

each other; scores range from a low value of "1", indicating that the interdependent teachers instructs the common students only once and in only one subject during the two-week period logged, to "50", indicating that the interdependent teachers instruct the common students in five subjects every day.*

The formula for the unit index is as follows:

$$\text{Intensity of Instructional Interdependence (INSCOAV)} = \frac{\text{Sum of frequency scores for each pair}}{\text{Number of instructionally-interdependent pairs}}$$

Note that this score does not describe the unit as a whole as do the diffusion scores but rather characterizes only those teachers involved in interdependence within the unit; as it turned out members of about half the total number of units engaged in no interdependence whatsoever.

Communication

For each unit, we wanted to know how widespread communication was and how frequently it occurred. From the raw communication data on both

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*Details of the scoring of teacher pairs are given in Packard, et. al., (1976), Appendix A.

classroom and school-wide matters, we counted the number of pairs of teachers reciprocally communicating in each unit to create indices called Diffusion of Communication -- Classroom Related (CSAT) and School-Wide Related (SCAT) -- in the unit.

$$\text{Diffusion of Communication (CSAT \& SCAT)} = \frac{\text{Number of pairs in communication}}{\frac{n(n-1)}{2}}$$

Where n = number of valid questionnaire responses in each unit.

Like the diffusion of instructional interdependence scores, this index ranges from "0" to "1.00".

In addition, using teacher pair scores assigned values of "1" (weekly or less), "2" (semi-weekly), or "5" (daily), we averaged the frequency of communication over all communicating pairs in the unit to form two different communication intensity indices -- Classroom-related (CLINT) and School-wide related (SCINT).

$$\text{Frequency of Classroom Communication (CLINT \& SCINT)} = \frac{\text{Sum of frequency of scores for each pair}}{\text{Number of pairs in communication}}$$

Analysis Incorporating Unit Characteristics: Successful vs. Unsuccessful Schools

With this perspective in mind, this paper will now examine some characteristics of units in Successful and Unsuccessful schools in an attempt to illuminate differences in teacher involvement in the innovation and to clarify some of the phenomena suggested by the school indices.

Focusing on the unit limited the analysis to the 16 "experimental" schools because no analogous substructure existed in the control schools, and we had to exclude T1 data (pre-implementation spring) from the analysis since units were not in existence at that time. In addition to these limitations, three of the 16 schools became ineligible for consideration in an analysis of the data from T2 to T5 because two of them had dissolved the unit structure during the second year of implementation and the third failed to turn in task interdependence data. The final sample for analysis included only 13 schools measured on the following schedule:

First Year of Implementation		Second Year of Implementation	
Fall 1974	Spring 1975	Fall 1975	Spring 1976
T2	T3	T4	T5

These 13 schools comprised a total of 55 units, varying widely in size and grade responsibility.

In the following analysis we aggregated the unit scores across all units in a school to produce a school score; these were again aggregated for the Successful and Unsuccessful groups in order to compare results with the original school score. Although this aggregation produces school scores, they depict fundamentally more specific aspects of the variables of interest than do our original school indices. (In the tables presenting unit-specific behavior, the slash separating two or more modal values indicates the distribution is bi- or multi-modal.)

Collegial Decision-Making

Teachers in the Successful schools engaged in less collegial decision-making in areas of classroom instructional processes at T2 than those in the Unsuccessful schools but they gradually increased their collegiality through T5, at which point they manifested the greater amount of collegial decision-making, although nonsignificant (Table 2). At T5, teachers in the Successful schools participated in significantly more collegial decision-making than those in Unsuccessful schools in areas of the deployment of students and teachers for instruction;* those in Unsuccessful schools did not change their level of collegiality much over the two years following the installation of units (slight drop) whereas the Successful schools showed a steady increase (Table 3). Were these pheonomena paralleled at the unit level?

Table 4 presents the UNITACT data for waves two through five. Although no significant differences existed between the two sets of schools, the trend was for a slightly greater incidence of unit level responsibility for decisions in the Successful schools, a difference which became most noticeable at T5.

The proportion of decisions made jointly by units in the Successful set stayed around the 30% level through time; only at T3 did the units in the Unsuccessful set reach 30%; most of the time they hovered around

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*This difference is to be expected because COLL2 at T5 is a criterion variable used to form Successful and Unsuccessful groups.

TABLE 2: MEANS AND STANDARD DEVIATIONS AT EACH WAVE FOR COLLEGIAL DECISION-MAKING ABOUT CLASSROOM INSTRUCTIONAL PROCESSES (COLL 1)

	T2*	T3	T4	T5
Successful				
Mean	13.30	19.30	16.80	24.20
S.D.	5.10	6.80	13.10	14.00
Unsuccessful				
Mean	27.60	16.80	14.70	15.30
S.D.	10.50	5.10	10.40	9.20

*Significant difference in means at $\alpha = .05$, df = 11

TABLE 3: MEANS AND STANDARD DEVIATIONS AT EACH WAVE FOR COLLEGIAL DECISION-MAKING ABOUT DEPLOYMENT OF STUDENTS FOR INSTRUCTION (COLL2)

	T2	T3	T4	T5*
Successful				
Mean	27.1	34.9	40.9	58.3
S.D.	13.9	12.5	25.1	20.9
Unsuccessful				
Mean	34.4	41.6	31.6	27.1
S.D.	23.8	26.2	20.6	26.2

*Significant difference in means at $\alpha = .05$, df = 11

TABLE 4: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA AT EACH WAVE FOR MANAGERIAL RESPONSIBILITY OF UNITS (UNITACT)

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	27.71	34.12	27.46	31.15	23.46	29.76	21.22	18.08
S.D.	16.57	18.49	17.67	15.97	15.03	15.26	16.44	16.02
Mode	20	40	0/13	15	20	20	0/15/28	0/10
Min-Max	0-55	0-70	0-61	0-60	0-60	0-60	0-53	0-60

*Significant difference in means at $\alpha = .05$, df = 11

20%. Given that five areas comprised the basis for computing the percentage, these figures indicate the units in Successful schools held responsibility for two of them whereas those in Unsuccessful schools held responsibility for only one.

The means suggest a consistent through-time difference in the Managerial Responsibility level of the units existed between the Successful and the Unsuccessful schools, a difference which became most pronounced at T5. Differences in modes and ranges existed only at T3. In Successful schools, units made 0% - 70% of the decisions in the five areas with most units reporting 40%; those in the Unsuccessful schools made 0% - 60% with most units reporting 20%. The modes decreased in both sets to about the same low level in the second year.

Just how meaningful these differences in mean percentages are is uncertain. The greater degree of collegial decision-making we had found in the deployment of students for instruction and at T2 in regard to classroom instructional processes in the Unsuccessful schools did not show up in the UNITACT scores. The discrepancy certainly may be explained by differences in the nature of collegiality as measured by the different instruments, beyond the notion that one specifically focuses upon unit-level decision-making. That is, the information or the nature of the decisions tapped by each may be sufficiently different to produce the observed differences (See Jovick, 1978); the benefit of employing the variable reflecting unit activity in order to illuminate the original school level analysis remains questionable.

Instructional Interdependence

The data in Table 5 for the total number of task interdependent pairs in each school suggest that teachers in the Unsuccessful schools abandoned this aspect of the innovation.

TABLE 5: AVERAGE TOTAL NUMBER OF PAIRS OF TEACHERS IN INSTRUCTIONAL INTERDEPENDENCE (NPI) AT EACH WAVE

	T2	T3	T4*	T5*
Successful				
Mean	5.6	6.8	5.0	5.1
S.D.	4.7	5.7	1.9	1.1
Unsuccessful				
Mean	4.7	4.8	1.8	2.0
S.D.	2.5	3.9	1.6	1.6

*Significant difference in means at [illegible]. The T5, and probably the T4, difference is to be expected because NPI at T5 was one of the criterion variables used to form the two groups.

TABLE 6: PERCENT OF NPI OCCURRING WITHIN UNITS EXCLUSIVELY AT EACH WAVE

	T2*	T3	T4	T5
Successful				
Mean	100.0	96.4	100.0	100.0
S.D.	0.0	9.5	0.0	0.0
Unsuccessful				
Mean	67.2	69.3	91.7	100.0
S.D.	35.7	37.2	20.4	0.0

*Significant difference in means at $\alpha = .05$, df = 11.

(Indeed, their T5 NPI is the same as their T1 NPI.) The two sets of schools did not look much different in their mean levels although the variance in the Successful schools was greater. Several related pieces of information about instructional interdependence in units illuminates these findings.

In each school we calculated the percentage of the total number of instructionally interdependent teacher pairs that were confined only to the members of units. Table 6 presents these percentages averaged for the Successful and Unsuccessful schools separately. Obviously, the successful schools were off to a start that was more consistent with the designs of the innovation -- that is, interdependence efforts were confined almost exclusively to unit members. Although the percentages for the Unsuccessful schools increased to this 100% level in the second year, this apparent increase loses its importance when we consider that the average total NPI on which it was based was quite low (two pairs). The information in Tables 7 and 8 give us an even more detailed picture of the differences in unit interdependence activities between the two sets of schools.

The Saturation of the Successful-school units with Instructional Interdependence (Table 7) stayed at a low-moderate level around .30 dipping only at T5 to .26. The Saturation indices for the Unsuccessful-school units were about half that size in Year 1 and nearly 4-5 times smaller in Year 2. The variation in the Successful-school units also tended to be greater. The modes and ranges were all the same, 0 and 0-1 respectively, except at T4 for the Unsuccessful-school units when the maximum dropped to .33.

TABLE 7: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR SATURATION OF UNITS WITH INSTRUCTIONAL INTERDEPENDENCE AT EACH WAVE (ISAT)

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	.31	.26	.31	.32	.17	.18	.06	.08
S.D.	.37	.31	.34	.38	.28	.32	.11	.20
Mode	0	0	0	0	0	0	0	0
Min-Max	0-1	0-1	0-1	0-1	0-1	0-1	0-.33	0-1

*Significant difference in means at $\alpha = .05$, df = 11

TABLE 8: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR AVERAGE INTENSITY OF INSTRUCTIONAL INTERDEPENDENCE IN UNITS AT EACH WAVE (INSCOAV)

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	7.27	9.85	9.38	10.32	9.24	10.78	17.94	16.70
S.D.	5.91	7.01	4.99	5.77	11.12	10.62	18.71	16.66
Mode	3	3	10	8/10	2/10	10	10	12
Min-Max	1.5-25.5	3-27	3-20	1-23.3	2-41.5	3-42.5	1-50	2-50

*Significant difference in means at $\alpha = .05$, df = 11.

The data suggest that the Successful-school units tended to have consistently more pairs of teachers interconnected in the sharing of students in the same subject areas. The extent of those interconnections remained relatively steady at each wave for units in the Successful schools, although that does not mean the pair-wise connections existed always between the same teachers through time. The extent of pairing in task interdependence within Unsuccessful-school units began low in general and ended even lower. The tendency to maintain some within-unit persistence in bonding was quite weak in these schools.

It should be noted that the ranges in both groups went from zero to 1.00. This means that, at each wave, the Successful set of schools still had some units in which no teachers shared kids in the same subject areas -- indeed, the modes are all at zero. Similarly, at each wave except T4, the Unsuccessful schools had some units in which teachers were maximally interconnected with each other in task interdependence.

The average frequency (INSCOAV) of sharing students by pairs in the units that had teachers participating in instructional interdependence stayed at about 10 in the Successful schools for both Years 1 and 2 (Table 8). In the Unsuccessful schools, it was about 10 in Year 1 and increased to about 17 in Year 2. The mode in both sets was about equal in Year 2 (about 10) but substantially lower in Year 1 for the Successful schools (3 vs. 10). The range for the Successful schools was about half that for the Unsuccessful schools.

The INSCOAV statistics by themselves give the impression that Instructional Interdependence, whenever it occurred, tended to be consistenly

more intense in the Unsuccessful-school units than in the Successful-school units. Data for ISAT for the two groups, however, indicate that the more intense level found in the Unsuccessful-school units was actually more a property of a few isolated pairs rather than of units, especially in Year 2. The higher ISAT levels in the Successful-school units tell us that, although the average frequency of sharing was somewhat lower than in Unsuccessful-school units, teachers carried on Instructional Interdependence more extensively within the unit. The intensity was slightly lower but it was also averaged over more interacting pairs.

The picture now seems somewhat clearer. By Year 2, Instructional Interdependence was an isolated teacher-pair phenomenon in the Unsuccessful schools but a unit phenomenon in the Successful schools.

To further distinquish Successful from Unsuccessful schools, Table 9 presents the proportion (percentage) of units in the school that actually had teachers who formed instructionally interdependent bonds; only units which had at least one pair of teachers connected (ISAT greater than zero) were counted in this percentage.* Obviously the Successful schools show consistently more pervasive unit activity in teaming at each wave than do the Unsuccessful schools. The percentages do not change much within each group except for the drop in Year 2 in the Unsuccessful schools.

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*This criterion is quite liberal in its characterization of "unit-wide" activity; the values disregard differences among units in intensity of or saturation with instructional interdependence.

TABLE 7: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR SATURATION OF UNITS WITH INSTRUCTIONAL INTERDEPENDENCE AT EACH WAVE (ISAT)

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	.31	.26	.31	.32	.17	.18	.06	.08
S.D.	.37	.31	.34	.38	.28	.32	.11	.20
Mode	0	0	0	0	0	0	0	0
Min-Max	0-1	0-1	0-1	0-1	0-1	0-1	0-.33	0-1

*Significant difference in means at $\alpha = .05$, df = 11

TABLE 8: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR AVERAGE INTENSITY OF INSTRUCTIONAL INTERDEPENDENCE IN UNITS AT EACH WAVE (INSCOAV)

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	7.27	9.85	9.38	10.32	9.24	10.78	17.94	16.70
S.D.	5.91	7.01	4.99	5.77	11.12	10.62	18.71	16.66
Mode	3	3	10	8/10	2/10	10	10	12
Min-Max	1.5-25.5	3-27	3-20	1-23.3	2-41.5	3-42.5	1-50	2-50

*Significant difference in means at $\alpha = .05$, df = 11.

TABLE 9: PERCENTAGES OF UNITS WITH ISAT GREATER THAN ZERO AT EACH WAVE*

	T2	T3	T4**	T5**
Successful				
Mean	60.5	62.9	72.9	63.6
S.D.	31.5	31.2	33.9	28.9
Unsuccessful				
Mean	36.1	36.1	25.0	27.8
S.D.	22.2	22.2	20.4	25.1

*Percentages were calculated for each school and then averaged for each group.

**Significant difference in means at $\alpha = .05$, $df = 11$.

Communication

The intensity of communication scores showed a greater average frequency of classroom interaction among teachers in the Unsuccessful schools in the first year (T2, T3) but by the end of the second year those in the Successful schools showed the greater average frequency. The same pattern appeared for the average frequency of interaction about school-wide matters but only the T5 difference was statistically significant. This is shown in Tables 10 and 11.

The Unsuccessful schools showed consistently more pairs in reciprocated classroom and school-wide communication through time although none of the differences were significant (most likely because of the large standard deviations and small n's). This is presented in Table 12 and 13.*

By investigation of reciprocated communication among unit members only we sought to illuminate these data further. Tables 14 and 15 present the aggregated communication saturation scores of units in Successful and Unsuccessful schools. Obviously no differences existed; indeed, the extensity of within-unit communication was quite near the maximum of 1.00 at each wave. Tables 16 and 17 present the aggregated communication intensity scores for units in Successful and Unsuccessful schools.

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*A check indicated that differences in the number of teachers in the schools in each set did not account for the differences in these communication extensity scores.

TABLE 10: MEANS AND STANDARD DEVIATIONS FOR INTENSITY OF CLASSROOM-RELATED RECIPROCATED COMMUNICATION (INTCL) AT EACH WAVE

	T2	T3*	T4	T5*
Successful				
Mean	2.11	2.07	2.27	2.55
S.D.	.37	.25	.23	.28
Unsuccessful				
Mean	2.35	2.7[illegible]	2[illegible]3	2.04
S.D.	.36	[illegible]	.33	.41

*Significant difference in means at $\alpha = .05$, df =.11

TABLE 11: MEANS AND STANDARD DEVIATIONS FOR INTENSITY OF SCHOOL-RELATED RECIPROCATED COMMUNICATION (INTSC) AT EACH WAVE

	T2	T3	T4	T5*
Successful				
Mean	1.86	1.91	2.03	2.33
S.D.	.36	.30	.20	.30
Unsuccessful				
Mean	1.93	2.17	1.98	1.81
S.D.	.33	.48	.25	.25

*Significant difference at $\alpha = .05$, df = 11

TABLE 12: MEANS AND STANDARD DEVIATIONS FOR INTENSITY OF CLASSROOM-RELATED RECIPROCATED COMMUNICATION (EXTCL) AT EACH WAVE

	T2	T3	T4	T5
Successful				
Mean	43.0	43.1	40.4	37.4
S.D.	24.7	25.5	24.6	19.5
Unsuccessful				
Mean	66.7	61.3	51.0	68.2
S.D.	63.7	50.3	24.3	43.7

*Significant difference in means at $\alpha = .05$, df = 11.

TABLE 13: MEANS AND STANDARD DEVIATIONS FOR EXTENSITY OF SCHOOL-RELATED RECIPROCATED COMMUNICATION (EXTSC) AT EACH WAVE

	T2	T3	T4	T5
Successful				
Mean	56.6	59.1	51.6	50.9
S.D.	38.2	39.7	32.3	32.5
Unsuccessful				
Mean	95.3	93.3	66.2	89.0
S.D.	73.2	70.5	33.3	57.7

*Significant difference in means at $\alpha = .05$, df = 11.

TABLE 14: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR EXTENSITY OF RECIPROCATED CLASSROOM-RELATED COMMUNICATION WITHIN UNITS (SATURATION: CSAT) AT EACH WAVE

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	.96	.86	.89	.92	.87	.89	.88	.88
S.D.	.09	.23	.20	.17	.22	.18	.20	.15
Mode	1	1	1	1	1	1	1	1
Min-Max	.67-1	.33-1	.33-1	.33-1.0	.17-1	.5-1	.33-1	.5-1

*Significant difference in means at $\alpha = .05$, df = 11

TABLE 15: MEANS, STANDARD DEVIATIONS, MODES, MINIMA, AND MAXIMA FOR EXTENSITY OF RECIPROCATED SCHOOL-RELATED COMMUNICATION WITHIN UNITS (SATURATION: SCAT) AT EACH WAVE

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	.93	.85	.96	.91	.78	.85	.92	.86
S.D.	.18	.28	.12	.20	.30	.26	.15	.20
Mode	1	1	1	1	1	1	1	1
Min-Max	.33-1	0-1	.6-1	.33-1	0-1	0-1	.5-1	.33-1

*Significant difference in means at $\alpha = .05$, df - 11.

TABLE 16: MEANS, STANDARD DEVIATIONS, MODES, MINIMA AND MAXIMA FOR INTENSITY OF RECIPROCATED CLASSROOM-RELATED COMMUNICATION (CLINT) AT EACH WAVE

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	3.29	3.49	3.93	4.00	3.64	3.83	3.56	3.37
S.D.	1.42	1.21	1.17	1.07	1.28	1.22	1.39	1.33
Mode	5	5	5	5	5	5	5	5
Min-Max	1-5	1.67-5	1.83-5	1.8-5	1-5	1-5	1.33-5	1-5

*Significant difference in means at $\alpha = .05$, df = 11.

TABLE 17: MEANS, STANDARD DEVIATIONS, MODES, MINIMA, AND MAXIMA FOR INTENSITY OF RECIPROCATED SCHOOL-RELATED COMMUNICATION (SCINT) AT EACH WAVE

	Successful				Unsuccessful			
	T2	T3	T4	T5	T2	T3	T4	T5
Mean	3.25	3.28	3.57	3.75	3.51	3.60	3.33	3.06
S.D.	1.55	1.35	1.35	1.26	1.33	1.40	1.39	1.25
Mode	5	5	5	5	5	5	5	5
Min-Max	1-5	1-5	1-5	1.33-5	1-5	1-5	1.33-5	1-5

*Significant difference in means at $\alpha = .05$, df = 11.

Again, no appreciable differences existed and all intensities were at a high level of three to four times per week.

These data suggest that the differences we observed in the more encompassing school level communication extensity measure was not due to within-unit differences. They also suggest that the intensity of interaction that occurred within units was quite high and not evident in the more encompassing intensity indices.

We had expected that the intensity and extensity of classroom-related communication, particularly within units would relate to the level of instructional interdependence. That is, the demands of coordinating instructional activities when sharing students in the same subject area would require more frequent interaction among all those involved in instructional interdependence. To assess this, we checked another within-unit aspect of communication, the percentage of daily classroom-related communication (five times per week) that was confined to members of units (Table 18). Again we see that no differences existed between the two sets of schools. It may be that the intensity levels of communication among teachers that had existed in the unitized and nonunitized schools were sufficient to support the demands from greater interdependence activities we found we found in the Successful set of schools.

TABLE 18: MEANS AND STANDARD DEVIATIONS FOR PERCENT OF DAILY CLASSROOM-RELATED RECIPROCATED COMMUNICATION (5 TIMES PER WEEK) WITHIN UNITS AT EACH WAVE

	T2	T3	T4	T5
Successful				
Mean	24.7	26.6	12.6	12.1
S.D.	12.8	21.6	16.0	10.9
Unsuccessful				
Mean	12.0	24.8	9.7	16.5
S.D.	10.9	14.6	11.5	15.5

*Significant difference in means at $\alpha = .05$, df = 11

Final Comment

Although the analysis with the unit specific information clarified some of the events occurring in the schools, it also dramatized some deficiencies in much of the initial analyses that used only the broader school-wide scores. The school level index of the number of interdependent pairs of teachers throughout the school could not reveal the more important finding from the unit-specific interdependence data that teaming was not a school-wide phenomenon.

Apparently, there was no such thing as a completely successful school for only the teaching team or the teacher pair emerged as the locus of implementation. In some schools the team acted as a group in carrying out instructional interdependence activities, in others isolated teacher pairs acted independent of other teachers within or outside of their assigned teams whenever they shared students. In either school setting, at each wave teams existed in which no one engaged in instructional interdependence whatsoever, even in the more "successful" schools.

Furthermore, although the unit specific communication indices suggested a great deal more interaction was occurring among teachers when we looked within units than across the school as a whole, the data also revealed that this within-unit communication was more intense than it was over the school as a whole. This suggests that the impressions we got of moderate school-wide communication were due to low communication -- numbers of teachers and frequencies of interaction -- between rather than within units. We could not have known this with the school-level indices alone.

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